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A race re-imaged, intersectional approach to academic mentoring: Exploring the perspectives and responses of womxn in science and engineering research

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ABSTRACT

In academic mentoring research, there is a need to include empirical designs that consider more sociocultural perspectives. The purpose of this exploratory study was to race re-image academic mentoring by considering its sociocultural perspectives (i.e., intersectionality, tokenism, and awareness).

For this, a qualitative-dominant, convergent mixed-methods approach was used to explore the perspectives and responses of twelve womxn graduate students and faculty involved in science and engineering research. Using multi-modal approaches that included two structured interviews and electrodermal activity (EDA) sensors, participants were asked to respond to case studies of achievement-, race-, and gender-equity through an academic mentoring lens.

Our qualitative findings suggested that across the interviews, issues of power, communication strategies, and awareness are predominant themes and needs of academic mentoring in theri respective disciplines. Furthermore, our quantitative findings supported the notion that throughout the interviews, varying forms of identities (e.g., social, institutional, discourse) appeared to predominate or interact throughout the cases explored. Together, the data points to the complex racial- and gender- influenced sociocultural perspectives of academic mentoring in science and engineering.

1. Introduction

1.1. Motivation

Originating from a theory on the evolution of life structure (e.g., Levinson, Darrow, Klein, Levinson, & McKee, 1978), the relationship between a mentor and a mentee has been deemed pivotal to the development of apprentices (Johnson, Rose, & Schlosser, 2007). As a result, a substantial amount of universities and academic programs rely on mentoring findings to create campus-wide programs and interventions, many of which aim to benefit all students equally (Armstrong & Jovanovic, 2015; Tenebaum, Crosby, & Gliner, 2001). Ironically, predominant reviews of mentoring research contest that studies on academic mentoring, particularly between faculty and students, are devoid of empirical research designs (Johnson et al., 2007; Johnson, 2016; Schunk & Mullen, 2013); theoretical ties (Jacobi, 1991; Schunk & Mullen, 2013); methodologically diverse approaches (Johnson et al., 2007; Olian, Carroll, Giannantonio, & Ferren, 1988; Schlosser & Gelso, 2001); or contextually-specific considerations (Johnson et al., 2007). Thus, to attend to this gap, our research team applied a *race re-imaged, intersectional* approach to academic mentoring (DeCuir-Gunby & Schutz, 2014) to explore the perspectives and responses of womxn[1] in science and engineering research. We chose to race re-image the construct of academic mentoring as researchers have recognized that current explorations of mentoring dynamics are devoid of race and other socially constructed lens (Johnson, 2016; Schunk & Mullen, 2013). For the purpose of this work, we used DeCuir-Gunby and Schutz's (2014) definition of race-imaged constructs:

> race-reimaged constructs are traditional constructs (e.g., self-efficacy, self-regulation, achievement motivation, etc.) that are re-conceptualized to include racially influenced, sociocultural perspectives (e.g. history, context, multiple identities, etc.) (p. 244)

Also, we used a qualitative-dominant, convergent mixed-methods approach to more comprehensively study racial experiences in academic mentoring as they are "often individualized despite common narratives amongst groups" (DeCuir-Gunby & Schutz, 2014, p. 254).

1.2. Academic mentoring as a race-reimaged construct

Research designs that have attempted to tie mentoring to theories, traditionally base the selection of these theories to principles found in

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[1] The term "womxn" was selected for this manuscript because we recognize that while gender is defined in the term "women", the "x" additionally acknowledges the prejudices, discriminations, and institutional barriers that many of these minoritized women have faced in our society (Kaufman, 2018).

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business and organizational structural models (Johnson et al., 2007); personal learning theories (Schunk & Mullen, 2013); social psychological theories of perceived similarity (Turban, Dougherty, & Lee, 2002); and student development theories (Rice & Brown, 1990), to name a few. Still, findings on the benefits and outcomes of mentoring continue to be mixed (DuBois, Holloway, Valentine, & Cooper, 2002; Johnson et al., 2007; Johnson, 2016). Prominent criticism by scholars regarding the nature of these mixed findings lies on the tendency of most researchers to categorize nearly every supportive or developmental relationship as mentoring (Johnson, 2016; Merriam, 1983; Mertz, 2004); the lack of an operational definition of mentoring (Merriam, 1983; Raggins, 1999); biased assumptions on the role and traits of a mentor (Johnson, 2016); little or no use of other methods or approaches such as qualitative research (e.g., Hill, Thompson, & Williams, 1997); and the lack of context-specific considerations of confounding covariates (e.g., gender, age, race, rank) in a mentoring relationship (Armstrong & Jovanovic, 2015; Johnson, 2016; Noe, Greenberger, & Wang, 2002). Additionally, researchers are beginning to suggest that mentoring outcomes cannot be fully understood without having a clearer understanding of the cognitive, behavioral, motivational, or affective influences of such relationships (Schunk & Mullen, 2013).

Also, traditional mentoring studies exploring issues of diversity and inequity tend to designate *moderating variables* (confounding covariates such as race, gender, age, etc.) in an additive way, limiting how mentoring dynamics are interpreted (Johnson, 2016; Schunk & Mullen, 2013). For example, while in some studies, career benefits and personal satisfaction are associated with cross-race mentorship, it is not correlated to specific race effects (Sosik & Godshalk, 2000) or in connection to gender (Beane-Katner, 2014; Corbett & Hill, 2015; Eddy & Gaston-Gayles, 2008) whereas other studies point to its modest benefits (for expanded literature reviews refer to DuBois et al., 2002; Johnson et al., 2007). As Raggins (1999) suggested decades earlier, most mentoring research operationalizes race as being related to phenotypes, a phenomenon still present today (DuBois et al., 2002; Johnson et al., 2007; Johnson, 2016). As Johnson (2016) suggests, we can't assume that moderating variables will alone "predict salient mentoring needs, relational styles, or professional concerns" (p. 175) as these can influence inferences, approaches, and interventions for individuals, and more specifically for those who are underrepresented.

A case in point can be found in the context of science, engineering, technology, and math (STEM), where findings suggest that the percentage of womxn of color in academia has decreased throughout the years [National Science Board (NSB), 2012]. Several factors are attributed to this decrease in representation such as increased burnout (Reif, 2010); heightened sense of self-doubt and isolation (Turner & Myers, 2000); unwarranted challenges to their competencies (Harris, 2007); emotional tolls due to multiple forms of discrimination (Turner & Myers, 2000); issues of tokenism (Blackwell, Mavriplis, & Snyder, 2009; Niemann, 2016); and inequitable service commitments such as advising and mentoring (Armstrong & Jovanovic, 2015).

It is noteworthy to mention that when exploring how university-sponsored programs establish mentoring interventions for traditionally-defined 'underrepresented' populations in fields like STEM, such as White women and men and women of color, many times these groups are considered additively or as a singular factor, which in reality only benefits a small group of individuals (Armstrong & Jovanovic, 2015). As such, mentoring programs and studies seeking to understand the influences of moderating variables such as race and gender must consider *intersectionality* (Crenshaw, 1989, 1991, 2012) as mentees can experience significant barriers due to traditionally male-dominated cultures and individualistic mentoring styles and structures (Cawyer, Simonds, & Davis, 2002; Johnson, 2016). As such, this study will race re-image the construct of academic mentoring, guided by the perspective of intersectionality.

Intersectionality[2] seeks to uncover the various ways that individuals are minoritized[3] within multiple contexts and structured systems as a consequence of the intersection of race and gender (Crenshaw, 1989, 1991, 2012). Without considering the intersectional elements of such moderating variables (e.g., race, gender) in mentoring, we risk creating an "omission in the research process" which can "paint an incomplete picture" (Davidson & Foster-Johnson, 2001, p. 554–555) of the dynamics present between mentors and mentees. These dynamics must consider the intersections of race, gender, socioeconomic status, ability, nationality, and other situated differences in society.

As a whole, empirical studies of mentoring, while still considered in its early stages (Johnson et al., 2007) point to a dire need to explore the structural, contextual, dynamic, and interacting elements that relate to an individual's experience, response, and perspective to this type of relationship. Since an individual's identity is contextual to the mentoring relationship (Johnson, 2016), it is equally important to explore if and how a mentor and/or mentee develops an awareness of their role and the nature of equity in these types of relationships.

This study was designed from an *intersectionality-informed* approach (Hunting, 2014; Rouhani, 2014) to attend to the call to *race re-image* educational psychology research (DeCuir-Gunby & Schutz, 2014). The goal of this study was to race re-image academic mentoring to help scholars re-conceptualize racially-influenced perspectives (e.g., intersectionality) in the dynamics of a mentoring relationship. Furthermore, this study aimed to re-image the methodologies traditionally used in academic mentoring research to include a qualitative-dominant (DeCuir-Gunby & Schutz, 2014) and intersectionality-informed (e.g., Rouhani, 2014), convergent mixed-method approach to explore these complex dynamics.

We re-imaged several components in this study as recommended by DeCuir-Gunby and Schutz (2014), Del Toro and Yoshikawa (2016), Johnson et al. (2007), Rouhani (2014), and Veenstra (2011): (1) the need to include other research designs other than quantitative and survey research – in our work, we used a qualitative-dominant, convergent mixed-method approach; (2) the need to employ innovative sampling techniques – in our work, we use a multi-modal approach (i.e., integrating electrodermal activity sensors with interview protocols) to uncover complex dynamics as participants responded to the interview questions and in addition, we applied analogue designs using vignettes of hypothetical mentors/mentees to minimize the "confounding effects due to the idiosyncrasies of real-life mentors, protégés, and organizations" (Johnson et al., 2007, p. 65); (3) the need to provide a definition of mentoring – in our study, we did this informally (explained in Section 4) by using Johnson's definition of *ethical mentoring* (Johnson, 2016), which defines it as a special relationship in which one person accepts the trust and confidence of another to act in the latter's best interest; we also included exemplars of vignettes based on Johnson's six ethical mentoring principles (Johnson, 2016) to provide context to the hypothetical scenarios; (4) the need to consider multi-stage analytical statistics to determine interactions between axes of inequity – in our study, we applied multi-stage statistical modeling using our electrodermal activity findings; and (5) the need to pay a greater attention to control variables and covariate analysis – our research applied a new approach based on our multi-modal design to allow participants, through their voices and perceptions, to determine their own 'controls'. Collectively, this intersectionality-informed approach (e.g.,

[2] Intersectionality is not just limited to race and gender as it recognizes the presence of politics, culture, class, wealth, access to prestige and power, citizenship, birth right, and other intertwined societal and structural mechanisms (Crenshaw, 1989, 1991, 2012). However, in our work, we focused primarily in race and gender as a starting call for scholars to use more intersectionality-informed approaches to study these and more moderating variables.

[3] The term "minoritized" was used here to recognize that marginalized groups may not have the same privileges or benefits compared to majority groups in the same system.

Rouhani, 2014) aimed to remove some of the traditional biases and assumptions of mentoring research (e.g., Johnson et al., 2007).

2. Literature review

2.1. Intersectionality

Moderating variables in academic mentoring such as race and gender are not mutually exclusive, but rather can intersect in various ways, affecting the experiences of individuals in multiple contexts and settings (Crenshaw, 1989, 1991, 2012). Crenshaw began to use the term *intersectionality* to describe the social injustice that African-American womxn were experiencing as a consequence of the intersection between race and gender in structural systems. Almost thirty years after introducing this concept, Crenshaw re-initiated a state of "urgency of intersectionality" studies to help frame the problem that womxn – and in particular womxn of color – still confront in our society. Intersectionality provides a definition and framework that helps scholars understand how individuals are marginally, contextually, or societally situated within structural systems due to the intersections of race, gender, class, heterosexism, transphobia, xenophobia, ableism, among others (Crenshaw, 1989, 1991, 2012). For example, *tokenism*, a type of social identity (Tajfel & Turner, 1986) results in the perverse visibility and convenient invisibility of being the distinctive minority in a group (Niemann, 1999, 2012, 2016). To identify this form of identity, an individual must express an awareness of the moderating presence of this variable to a given context (e.g., mentoring). *Awareness* is a broad term defining individuals' level of conscious or unconscious processing of an experience that may or may not have been reflected upon previously (Winkielman & Schooler, 2011). In this work, we explored in more detail the interactions of three forms of identities stemming from Gee's research (2000, chap. 3).

Seminal work from Gee (2000, chap. 3) discusses four ways to view identity: (a) nature identity, (b) institution identity, (c) discourse identity, and (d) affinity identity. Nature identity considers a state of identity that an individual has no control over (e.g., their birth). Institution identity relies on a part of an identity where an institution or governing authorization (via rules, laws, traditions, or principles) positions individuals to uphold their rights and responsibilities. Also, this form of identity is placed on a "continuum in terms of how actively or passively the occupant of a position fills or fulfills" their role or duties (Gee, 2000, chap. 3, p. 103). Discourse identity is part of an individual trait whose interaction with others determines the behaviors, positions, significant semiotic events, or actions that a person may take in a range of interactions. Affinity identity consists of individuals in a group whose allegiance, access, and participation to specified practices provide each of its members the requisite experiences.

An individual cannot have an identity without considering the interpretive system that is underwritten to recognize this identity (Taylor, 1994). In other words, people can accept, contest, or negotiate identity in terms of how they perceive they will be seen or recognized (Taylor, 1994). For example, in the context of science and engineering, identity can be interpreted as being socially-based (Kim, Sinatra, & Seyranian, 2018) or institutionally-based (Gee, 2000, chap. 3). More specifically, for social identity, individuals must consider the extent by which they see themselves as belonging to a social group (e.g., being womxn, Latinx,[4] a scientist) or discipline (Tajfel & Turner, 1986).

In our study, since representation of womxn in science and engineering has been reported to be low [National Science Foundation (NSF), 2017], identities could be negotiated, contested, or self-regulated within the context of their disciplines and roles. Kanter, in her seminal study (1977), concluded that womxn who were few in numbers among their male peers and often had the "only woman" status became tokens: symbols of how underrepresented womxn become stand-ins for all womxn. Yet, these forms of tokenistic labels may not fully consider the fluid ways that an individual relies on to express or acknowledge their intersecting identities in light of an oppressive context. As shown in Fig. 1, we believe that the fluidity and interactions between identities in the face of oppression can ignite varying forms of self-awareness and psychophysiological responses. For the purpose of this work, *psychophysiological response* refers to an automatic physical reaction triggered by a psychological stimulus used to understand the interactions between bodily and mental processes (Andreassi, 2007).

Understanding an individual's response to a context, can help scholars better understand the underlying "fiscal, emotional, psychological, and other categories" (Kwan, 2000, p. 687) that inform participants' interpretive systems about topics such as academic mentoring in research. In the figure above, we used the analogy of a water pipe to convey our point. In a water pipe whose flow has been interrupted by a reduction in pipe size (i.e., a factor external to its control) turbulence can form. Similarly, identities are fluid and when interrupted by a system of oppression (i.e., outside of the individual's control), can result in various intersecting identities that inform how individuals express and respond to a given context, situation, or relationship.

Tokenism. Research in higher education continues to show race and gender inequalities among faculty (Medina & Luna, 2000; Niemann, 1999, 2012, 2016) and student populations (Mondisa, 2015; Pollak & Niemann, 1998). Kanter's (1977) seminal study states that the number of socially distinct people in a group shapes group dynamics and creates a situation of tokens and dominants, with tokens experiencing heightened visibility or invisibility. The comparatively small proportion of womxn and minorities coupled with social inequalities in academia creates an environment where minoritized individuals have been often labelled as having a token status, or what researchers agree is the perverse visibility and convenient invisibility of being the distinctive minority in a group (Niemann, 1999, 2012, 2016). Niemann (2016) states that,

> Faculty of color enter their positions as colleagues, scholars, and experts in their field, but their overarching identity quickly shifts to being Black, Brown, Asian, or Indian faculty member. Their racial identity becomes the lens through which they are perceived, especially for the diversity-related needs of the university and communities within and around it (p. 453).

Token minority faculty are often overburdened with administrative or service-related duties (Bowen, 2012; Medina & Luna, 2000), which can affect the potential for meaningful relationships with students and junior faculty. Tokenized faculty sometimes question their scholarly abilities by internalizing perceived stereotypes all the while feeling like they are valued in their academic departments only because of their minority background (Medina & Luna, 2000). The implications of tokenism for womxn and minority faculty in higher education can ignite negative professional and personal outcomes (Niemann, 2012, 2016), which could influence how a faculty becomes a mentor (Johnson, 2016).

Womxn students in a minoritized situation or solo status (i.e., the only woman) can be subjected to stereotyping based on their token labels, which can lead to underperformance on tasks that deviate from these gender roles and stereotypes, like mathematics exams (Inzlicht & Ben-Zeev, 2003). One study revealed that non-white womxn students in science were treated as *exceptionalists*, or outliers in their identity group (s) based on their scholarly ability, which does not compare to how that population fares nationally (Bowen, 2012). This contributes to stereotyped beliefs about minority womxn's academic ability in certain disciplines. Therefore, womxn in STEM fields who are underrepresented, may carry a negative self-evaluation informed by stereotypical expectations that arise from internalized beliefs. Viewing students as tokens or exceptionalists, and stereotyping minorities in STEM could lead

[4] Latinx is a gender-neutral noun to identify individuals from Latin American origins (Salinas & Lozano, 2017).

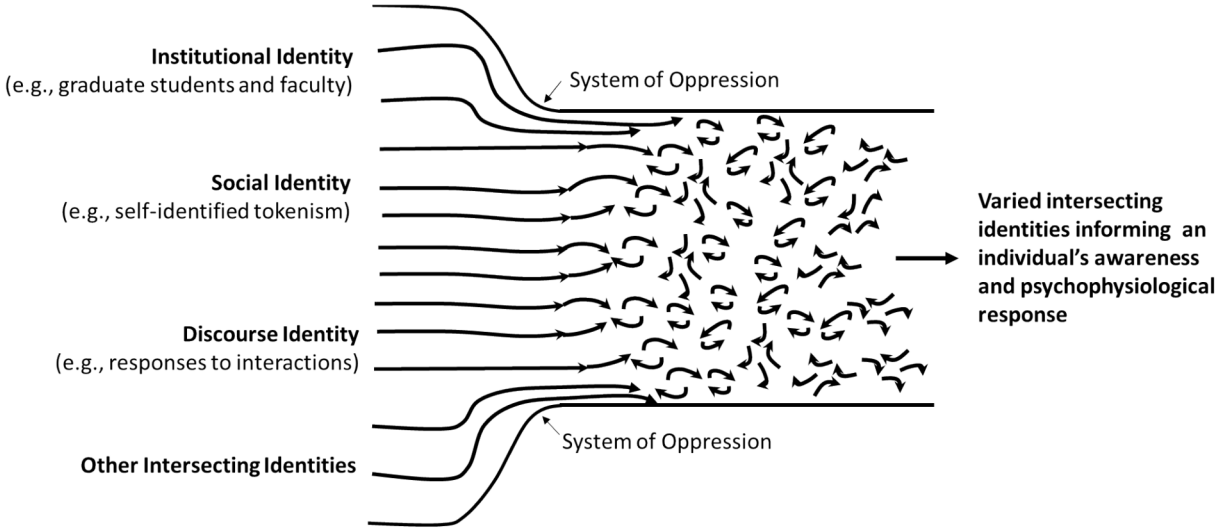


Fig. 1. Schematic proposing the fluid interactions of intersectional identities to situations or systems of oppression and its influences on awareness and psychophysiological response.

to an invisibility where their intersectional identities are not acknowledged or honored appropriately in their fields of study (Armstrong & Jovanovic, 2015; Mondisa, 2015; Samuels & Ross-Sheriff, 2008).

Intersectionality posits that the experiences of these 'tokens' cannot be explored without considering elements such as gender, race, migration status, history, social class, sexuality, health, disability status, among others (Armstrong & Jovanovic, 2015; Mondisa, 2015; Samuels & Ross-Sheriff, 2008). For example, McDonald, Toussaint, and Schweiger (2004) found that token womxn who are placed in leadership roles normally dominated by male groups, experience twice the amount of anxiety and performance pressures compared to men (McDonald, Toussaint, & Schweiger, 2004). It remains unclear, however, *how* these womxn in high pressure fields like science and engineering express and psychophysiologically respond to their tokenistic labels and in these types of contexts. Understanding the 'how' and 'what' of these issues can help researchers develop more customized and equitable interventions to mitigate the negative influences of tokenism and inequity for womxn in these fields.

Awareness. Recent advances in social and cognitive psychology, particularly in the area of metacognition (i.e., an individuals' beliefs about their mental states) (Koriat, 2006) and in the development of neuroscientific approaches to psychological research (Azevedo, 2006; Immordino-Yang & Christodoulou, 2014; Pekrun, 2016; Pekrun & Linnenbrink-Garcia, 2014; Stump, Husman, & Corby, 2014; Winkielman & Schooler, 2011) has expanded researchers' understanding about consciousness and its levels of awareness (Winkielman & Schooler, 2011). The term "conscious" can carry many interpretations (Winkielman & Schooler, 2011; Zeeman, 2002) but in general, it involves a person directly *seeing*, *knowing*, or *feeling* a particular mental content rather than having to indirectly infer upon it. Mental content can be categorized as: (a) genuinely unconscious; (b) experientially conscious; or (c) meta-conscious (Winkielman & Schooler, 2011; Winkielman, Berridge, & Sher, 2011). Genuinely unconscious implies that individuals are not cognizant about what is being presented. Experientially conscious exists when individuals that are having ongoing experiences are not reflecting upon them. For example, individuals may not be aware that they can recognize larger amounts of information after viewing an image but can recall them when asked (Sperling, 1960). Meta-consciousness represents the explicit information that is present in one's own consciousness about a certain experience (Schooler, 2001, 2002). Among the types of meta-consciousness that exists, *translation dissociation* occurs if the internal recollection of one's consciousness misrepresents the original experience. For example, researchers working on aversive racism have found that individuals who reveal their implicit racisms are not capable of consciously communicating their racist tendencies (e.g., Son Hing, Chung-Yan, Grunfeld, Robichaud, & Zanna, 2005). Such inconsistencies involve discourses between what they experience (e.g., negative affect) and what they are aware of regarding this experience (Son Hing et al., 2005).

Research in this field is beginning to suggest that one's consciousness represents activations of many neurocognitive and psychophysiological processes (e.g., synchronous activation of higher associative cortices such as prefrontal cortex; arousals in electrodermal activity – EDA) (Dehaene, Changeux, Naccache, Sackur, & Sergent, 2006; Lamme, 2004; Singer, 2000; Tonini, 2004). However, most of the findings to date are conducted on severely impaired patients (Winkielman & Schooler, 2011) so interpretations that include these psychophysiological connections are considered to be "suggestive" at most (Winkielman et al., 2011, p. 197). Our study explored if among more healthy individuals, a reflection and internalization of the term 'tokenism' in the context of academic mentoring in research, elicited differential psychophysiological responses and if these were informed by their intersecting identities.

Collectively, the information presented shows a need to race re-image academic mentoring. As stated before, race re-imagining involves a reconceptualization of traditional constructs (e.g., self-efficacy, self-regulation, etc.) to include "racially influenced sociocultural perspectives (e.g., history, context, multiple identities, etc.)" (DeCuir-Gunby & Schutz, 2014, p. 244). As such, we aimed to include perspectives that considered intersectional identities, tokenism, and awareness. These perspectives, in our viewpoint, can begin to help scholars understand the complex web of realities that many participants, and in particular, underrepresented womxn may face in science and engineering research during their mentoring relationships.

3. Research questions

The overarching research question for this study is:

RQ1. How can academic mentoring, as a construct, be race re-imaged?

To explore this overarching question, three sub-research questions were selected as the perspectives that would help us race re-image academic mentoring from the following perspectives (intersectional identities, tokenism, and awareness):

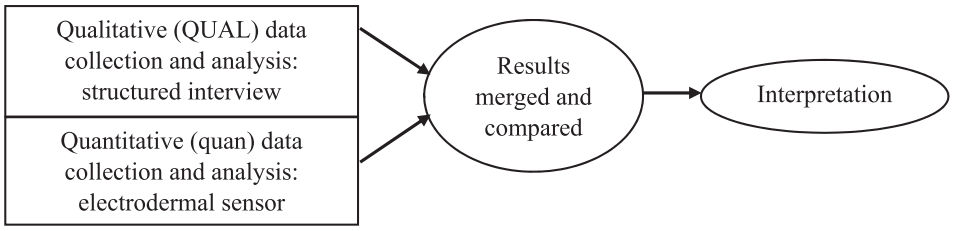


Fig. 2. A modified schematic diagram representing the convergent mixed-method study design, as described in Creswell and Plano-Clark (2018, p. 66).

RQ 1a. How does intersectional identities among womxn faculty and graduate students in science and engineering influence their responses to academic mentoring?
RQ 1b. How does tokenism, if any, influence womxn faculty and graduate students in science and engineering's responses to academic mentoring?
RQ 1c. How does awareness, if any, influence womxn faculty and graduate students in science and engineering's responses to academic mentoring?

4. Methods

4.1. Research design

In presenting our theoretical framework and developing our research design, we attempted to answer the longstanding call to "revisit our philosophical assumptions and broaden our methodological approaches in order to better explore race-focused and race-reimaged constructs" (DeCuir-Gunby & Schutz, 2014, p. 252). Given the complex and intertwined nature of our work, we developed a qualitative-dominant, convergent mixed-method research approach (Fig. 2; Creswell & Plano-Clark, 2018; DeCuir-Gunby & Schutz, 2014). This research was also designed in response to recommendations from Rouhani (2014) and Del Toro and Yoshikawa (2016) to consider including perspectives of intersectionality on mixed-method designs. By including an "intersectionality-informed" (Hunting, 2014, p. 1) perspective in this methodology, we can more deeply investigate the "multi-dimensional nature of individuals' lives and how they interpret and navigate their day-to-day experiences of power and privilege" (Hunting, 2014, p. 1).

Please note that the higher caps in the acronyms for qualitative (QUAL) and the lower caps in quantitative (quan) findings denote primary and secondary emphasis in this work, respectively. Also, for this study, informed consent for experiment with human subjects was obtained and privacy rights of the human subjects were observed and ensured through approval from the Institutional Review Board (IRB) of the home institution of first author of this paper.

4.2. Researcher positionalities

All members of this research team are minoritized individuals whose intersectional identities informed the lens of this study. All bring a breadth and depth of experiences and perspectives whose careful and rigorous approach to this study aimed to consider the varied thoughts, perspectives, voices, and psychophysiological responses of womxn in science and engineering to cases of academic mentoring in research and in light of tokenism.

4.3. Participants

We used purposeful and snowball sampling (Glesne, 2006) for this study. The criteria to select participants included: (a) gender (primarily from those that may be considered underrepresented or minoritized in their fields or research areas, i.e., womxn); (b) discipline (science or engineering); (c) time spent in a research relationship (e.g., six months or more); and (d) graduate students and faculty. It is worth mentioning that we made a conscious effort to avoid re-inscribing a tokenistic view on these womxn in STEM and did not assume that each of them could be representative of their field and ethnic group (Del Toro & Yoshikawa, 2016). Instead, we strived to magnify their individual experiences under the consideration of their positionality and individual perspectives on whether they believed the role of tokenism influenced their own academic mentoring relationships. This was self-assessed by the participants themselves when we emailed them information about the purpose of the study and when they were asked to identify issues of tokenism on given cases (explained later in Section 4 of the manuscript).

All participants who fulfilled the requirements and expressed an interest in the study were recruited. Even though a predominant number of White/Caucasian womxn responded to our call, we aimed to collect the most diverse sample available based upon our inclusion criteria and did not target a specific ethnic group on purpose. Note that for science and engineering disciplines, we were not able to find faculty of color or of a race different than White/Caucasian given their very limited representation in the field at the institution of the study as well as nationwide (NSF, 2017; United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2016). We excluded: (a) male faculty and male graduate students; and (b) womxn graduate students and faculty with less than six months of an academic research relationship because the purpose of this study was to acquire context based on their research relationships as well as make sure participants had a period of adjustment in their research relationships (Johnson, 2016). Our rationale for not including male participants is that we wanted to place womxn's lives and experiences at the front and center of this study (Disch & Hawkesworth, 2018; Shaw & Lee, 2014).

From participant recruitment efforts, eight womxn graduate students and four womxn faculty (n = 12) were recruited from the Colleges of Science and Engineering at a western institution of higher education in the United States, each having varied roles (e.g., Full professor, Assistant professor, Ph.D. student, M.S. student) and disciplines. We assigned pseudonyms to the twelve participants to ensure participants' privacy and confidentiality (Christians, 2005). We recognize that assigning a pseudonym for anonymity purposes "is not merely a technical procedure, but renaming has psychological meaning to both the participants and the content and process of the research" (Allen & Wiles, 2016, p. 149). Hence, we took particular care in choosing pseudonyms that would minimize the risk of creating misconceptions and stereotypes connected to participants' moderating variables (e.g., age, socio-cultural background, socio-economic status) as portrayed in Table 1.

4.4. Using electrodermal activity in psychopsychophysiological research

This exploratory study applied a multi-modal approach that blends electrodermal activity with interview protocols to understand their perspectives and responses closer-to-real-time. Also, since exploring these issues may constitute a sensitive topic to participants and may influence how minoritized individuals manage their emotions (Evans & Moore, 2015; Mirchandani, 2003), exploring participants' psychophysiological arousals during their interviews was deemed important in helping us more deeply understand the dynamic nature of moderating variables in academic mentoring cases.

Table 1
Faculty and graduate student participant information (adapted from Gelles et al., 2017, 2018).

Pseudonym (Participant Number)	Role	Time in a research relationship (years)	Number of research advising mentors/mentees	Number of womxn mentors/mentees	Legal relationship status	Children?	Country of origin	Self-identified race/ethnicity	First generation?
Kate (Participant 1)	Ph.D. Student, Science	4	4	2	Single	No	U.S./Canada	White	No
Kira (Participant 2)	Ph.D. Student, Science	7	2	2	Single	No	U.S.	White	No
Chelsea (Participant 3)	M.S. Student, Engineering	7	1	1	Single	No	U.S.	White	No
Lindsay (Participant 4)	M.S./Ph.D. Student, Engineering	0.5	2	0	Single	No	U.S.	White	No
Bailey (Participant 5)	M.S. Student, Science	3	2	1	Married	No	U.S.	White/Asian (Korean)	Yes
Beatrice (Participant 6)	Ph.D. Student, Science	+3	2	1	Married	Yes	Argentina	White/Latina	Yes
Bridgette (Participant 7)	Ph.D. Student, Engineering	2	2	1	Single	No	India	Asian	No
Carrie (Participant 8)	Ph.D. Student, Engineering	2.5	2	0	Single	No	Dominican Republic	Black/Latina	No
Barbara (Participant 9)	Full Professor, Science	26	30	7	Married	Yes	U.S.	White	No
Valerie (Participant 10)	Full Professor, Science	30	35	+15	Married	No	U.S./Belgium	White	No
Hailee (Participant 11)	Assistant Professor, Engineering	10	9	3	Married	Yes	U.S.	White	Yes
Kendra (Participant 12)	Associate Professor, Science	19	26	19	Married	Yes	U.S.	White	No

Initial studies that explored the roles of emotions in consciousness came from researchers who studied the influences of subliminal stimuli at triggering affective reactions (Winkielman et al., 2011). In a study from Monahan et al. (2000), individuals were subliminally exposed to several repeated neutral stimuli with visual patterns while another group was provided with non-repeated stimuli. The former group reported more positive feelings compared to the latter group. In another study, subliminal scenes highlighting phobias were presented to a group of participants. These individuals self-reported experiencing negative affect (i.e., anxiety) to these scenes. One study showed that when unconscious stimuli in the form of ideographs containing happy or sad faces was presented to Chinese participants, an increase in neural stimuli was seen among participants for the happy faces and a decrease in stimuli was found for the sad faces suggesting the presence of unconscious emotions (Winkielman, Zajonc, & Schwarz, 1997). Other studies have shown that skin conductance in the form of EDA can be triggered by subliminally presenting emotional words (Lazarus & McCleary, 1951) or images aimed at producing emotions such as fear (Öhman, Hamm, & Hugdahl, 2000). More recently, a study from Villanueva, Raikes, Ruben, Scheafer, and Gunther (2014) showed that interviews that relied on self-reflection and recollection of former academic experiences also elicited psychophysiological arousal (in the form of EDA) among participants. Psychophysiological arousal has been tied to behavioral regulation of emotion for different at-risk groups in the context of triggering emotions such as frustration (Zantinge, van Rijn, Stockmann, & Swaab, 2017). Collectively, the findings point to the potential that subliminal presentation of information and reflection could have in an individual's affective reactions and responses to topics that may require emotional processing (e.g., tokenism, mentoring).

4.5. Electrodermal activity considerations for participant recruitment

Given the nature of this study, we aimed to keep the number of participants for the interviews to less than 20 to facilitate an "association with the respondents, and enhance the validity of fine-grained, in-depth inquiry" in this naturalistic setting (Crouch & McKenzie, 2006, p. 483; Hatch, 2002; Morse, 1994). We understand that by doing so, we may have compromised participant validity (Campbell & Stanley, 2015), which may limit the generalizability of these results. On the other hand, our aim was to maintain as close of an ecological validity (Campbell & Stanley, 2015) to standard ways of interviewing as possible while ensuring that as a research team we were cognizant that no intersecting identity may be the same (Gee, 2000, chap. 3). We also wanted to limit the number of intersections studied in our participants and as such, our sample size was small per recommendations from intersectionality-informed research designs (Del Toro & Yoshikawa, 2016; Hunting, 2014; Rouhani, 2014).

All participants wore a non-invasive electrodermal activity (EDA) wrist sensor during the interviews to measure the amount of sweat secreted from the participants' skin (Boucsein, 2012). Regarding the latter point, we want to note that the sensor data collected is very ample given that EDA data is measured near-real time (every second of an interview represented 4 data points). The EDA data collected in this study averaged ~14,400–18,000 data points per participant, which required separation, filtration, modeling, and normalization of data. Boucsein (2012) suggests that participant numbers, whose EDA data is collected from, do not have to be vast given the complicated nature of, the difficulty in data processing, and the challenges associated with calibrating the sensors for each participant. Furthermore, from an intersectionality-informed standpoint, modeling the psychophysiological data collected required multi-stage analytical strategies (Veenstra, 2011) to "determine statistical interactions (i.e., intersections) between axes of inequity" (Rouhani, 2014, p. 9), which would exceed existing capacities of many statistical programs given the high amount of EDA data collected from the participants (Benson, emailed communication, December 4, 2018).

In order to invoke and collect emotions among participants, as recommended by other researchers (Villanueva et al., 2014; Boucsein, 2012), we selected a topic that is commonly known to generate critical positions and opinions in science and engineering. More specifically, the topic of equity in academic mentoring in research was selected due to its controversial stance in the fields (Johnson, 2016; Zhang, 2017). Furthermore, literature suggests that among womxn relationships in academia, issues of equity and ethics of mentoring are of vast importance when considering becoming a faculty mentor (Rose, 2005). To minimize bias in case study selection, the case studies were discussed at length by the research team so that the most relevant case studies for both graduate students and faculty in science and engineering were selected given the research teams' own positionalities and experiences in these and similar fields.

4.6. Interview protocol overview

The work presented in this manuscript expands upon the results of two structured interviews that explored participants' reactions and perceptions around the academic mentoring in research typically found between a faculty mentor and a graduate student mentee (Gelles, Villanueva, & Di Stefano, 2019). Academic relationships were primarily presented through the demographic questions and was crafted based on Johnson's (2016) work on ethical mentoring and its six principles were presented as case studies. According to Johnson (2016), ethical principles of mentoring include: (a) *Beneficence* (mentor/mentees obligation to promote best professional interests), (b) *Nonmaleficence* (avoidance of using mentor/mentees role for harm), (c) *Autonomy* (mentor/mentees avoidance of promoting dependency vs. independence), (d) *Fidelity* (mentor/mentees sense of loyalty), (e) *Fairness* (mentor/mentee safeguarding of equal treatment), and (f) *Privacy* (mentors/mentees avoidance to reveal sensitive material without consent). In this study, we only focused on three cases (Beneficence, Autonomy, and Fairness).

Our research team opted to not include a formal definition of *academic mentoring* in research relationships on either interview but rather indirectly prompted participants to come up with their own conclusions on what this term meant to them (e.g., How many research mentors have you had?; Gelles, Villanueva, & Di Stefano, 2017, 2018; Gelles et al., 2019). For the first structured interview, questions around three case studies (described below) were asked and no definition of tokenism was provided. One to four weeks later, the same participants were scheduled for a second structured interview, where the same interview questions and cases were asked but this time, participants were introduced to Niemann's definition of tokenism (Niemann, 2012, 2016). This allowed participants to re-acclimate to their research environments and allow for a period of reflection. In both interviews, participants expressed their values, beliefs, and attitudes about the structured questions (Gelles et al., 2017, 2018, 2019) *while* wearing an electrodermal (EDA) wrist sensor to record their psychophysiological arousals to the questions, similar to the method described by Villanueva and others (Villanueva et al., 2014).

The researchers who conducted the interviews were involved in one of two ways: (a) one researcher asked the interview questions and timestamped the onset of an interview question; or (b) an accompanying researcher sat in the background silently and timestamped the onset of each interview question while another researcher asked the questions. For both cases, the timestamping of the onset of the interview questions as well as any unforeseen events (participants showed visible signs of distress) was conducted using a custom-created Excel Macro program developed by the research team.

At the beginning of the interview, participants were told that they could stop or withdraw at any time if they felt uncomfortable with providing a response to the questions. After participants read each case study, ten structured interview questions were asked and participants provided their verbal responses *while* wearing the EDA wrist sensor. A researcher marked the onset of each interview question. Interview questions are included in Table 2. These questions were selected after reviewing Johnson's book on ethical mentoring (2016) and the case studies presented.

Table 2
Interview Questions; note that for the second interview the statement of tokenism was added contrary to first interview.

Interview Questions per Case Study
Before reading the case study:
1. What do you think is important in a research relationship in your field?
2. What do you consider are the positive attributes of a productive mentoring research relationship in your field?
3. What do you consider are the negative attributes of a research relationship in your field?
After reading the case study:
4. Related to the case study you just read, did you identify issues of Tokenism? Explain.
5. Keeping in mind the definition of Tokenism provided:
a. Did you find any items in the case study that caught your attention? Explain.
b. What advice would you have given to the individual undergoing this experience in their research relationship?
c. Do you think that this case study contained ethical issues? Explain.
d. What behaviors would you expect from your faculty mentor or graduate student mentee if placed in a similar situation to the case study?
e. What take-home message could you apply to your own research relationship?
6. From your current role as a graduate student mentee or faculty mentor, do you think the issue of Tokenism plays a significant role in your research relationship? Why or why not?

The research questions were framed in a way consistent to what is recommended in the electrodermal activity and psychopsychophysiological literature to invoke emotional arousals among the participants through a subliminal presentation of stimuli (e.g., cases) (Villanueva et al., 2014; Winkielman et al., 2011). It is important to mention that participants attended a 15–30 min orientation session 1–2 weeks prior to the first interview where we explained the purpose of the study, the use of the sensors, any dietary restrictions needed to use this sensor (Villanueva, Valladares, & Goodridge, 2016), and to answer any questions they may have had about the study. No participant appeared to have any questions related to what an academic mentoring in research was or the purpose and procedures in this study. Also, the definition of tokenism according to Niemann (2012, 2016) was presented to the participants in paper form and only in the second interview. This definition was available to the participant throughout the entire interview and participants could access the definition as many times as they wanted.

4.7. Selection of case studies for the interviews

For the two interviews, a total of six cases were presented. For the purpose of this paper, we will present only three of them: (a) an "achievement-equity" case study denoting a well-known phenomenon surrounding publications and academic recognition in research environments; (b) a "gender-equity" case study suggesting potential gender-specific issues around the role of initiating a family while pursuing academic research; and (c) a "race-equity" case study exposing issues of potential discrimination in academic research admission procedures. A summary of the three case studies is provided in Table 3.

It is important to note that because this exploratory study has a convergent mixed-methods design, the quantitative data collection and analysis aspects of this design needed to be considered during the execution of the interview protocol. At the same time, the research team strived to stay true to the intended intersectionality-informed approach to conduct and analyze the study. These considerations were especially important in the designation of a "control case study" by which to conduct quantitative comparisons among the participants during data analysis. As such, instead of having the research team assume the conditions by which a "control case study" would be assigned,

Table 3
Selected case studies (adapted from Gelles et al., 2017, 2018, 2019; Johnson, 2016).

Case Study & Ethical Mentoring Principle	Definition	Case Study Text
"Achievement-equity" case: Principle of Beneficence Case 5.8 (Johnson, 2016, p. 82)	Mentor/mentees obligation to promote best professional interests.	An assistant professor at a highly selective undergraduate technical university, Frank quickly acquired a cadre of loyal and talented engineering student mentees. In addition to offering energetic coaching and sincere personal support, Frank began to understand that it was often up to him to provide the "push" and challenge many students required to develop confidence and polish skills. Too often, talented students were reluctant to take risks, face anxieties, or rise to the level of excellence Frank clearly expected. So Frank challenged students to collaborate with him on projects, submit papers for conference presentations, offer their work for national design competitions, and even serve as "guest lecturers" in his freshman course. Of course, he provided the requisite encouragement, and rarely did he make the mistake of asking a student to attempt more than he or she could handle. As a result of Frank's relentless challenges, his students were often better prepared in the terms of both credentials (achievements) and professional confidence when graduation rolled around.
"Gender-equity case: Principle of Autonomy Case 14.3 (Johnson, 2016, p. 213)	Mentor/mentees avoidance of promoting dependency vs. independence.	A first-year graduate in a history Ph.D. program, Sandra was initially delighted when one of the few female full professors in the department began to show an interest in her. Dr. Copie encouraged Sandra to join her small research group of graduate students and junior faculty focused on historical criticism from a feminist perspective. Over three years and a successful master's thesis, it became clear to Sandra that the more Dr. Copie invested in their relationship, the more pressure she felt to research only in Dr. Copie's area of interest, to pursue a career trajectory very similar to that of Dr. Copie, and even to forego a family until after completion of her doctorate—as did Dr. Copie. Although her mentor appeared entirely unaware of it, it was crystal clear to Sandra that her mentor's approval and interest hinged directly on Sandra's willingness to follow Dr. Copie's own career path.
"Race-equity" case: Principle of Fairness Case 8.16 (Johnson, 2016, p. 131)	Mentor/mentees safeguarding of equal treatment.	A Hispanic male student in the second year of a doctoral program complains to the department chair that he was discriminated against in securing the faculty mentor of his choice. He asserts (and has evidence to demonstrate) that he has better grades, higher GRE scores, and more publication experience as an undergraduate than any students in the program. Because his research interests and prior publications were in the specialty area of a senior female professor in his department, Dr. Select, he approached her with a request for advising and program sponsorship. He was told she had no current openings for students. However, 2 months later, Dr. Select accepted as a new advisee a White male student in the same cohort. This student had no publications, no experience in Dr. Select's area of research, but "better looks" according to the student making the complaint. He believes the decision was based on race, attractiveness, or both.

participants themselves identified informally their own "control case study" through their verbal and psychophysiological arousal responses to the cases in the interviews as explained below.

Among participants' verbal responses, the researchers considered: (a) if participants personally identified that a case study contained issues of tokenism; and (b) if they self-identified as being or having a tokenistic status in their fields of research. For psychophysiological arousal responses, the research team measured the EDA values (explained in the quantitative data collection and analysis section of the manuscript) of participants across the cases and interviews. Together, the verbal and psychophysiological responses helped shed light on a "control case study" that originated from the participants themselves while also minimizing our introduction of any potential biases that would traditionally be present in quantitative studies of this nature (Del Toro & Yoshikawa, 2016; Rouhani, 2014).

4.8. Qualitative data collection and analysis (QUAL)

For the QUAL portion of the data, the research team collected participants' interview responses that were paired with researchers' member checking-responses to ensure trustworthiness and internal validity and to avoid errors of interpretation (Lincoln & Guba, 1985; Santos, Silva, & Magalhaes, 2017). We also conducted a focus group in the form of an anonymous online discussion board that included preliminary findings and initial researcher interpretations that was shared with the participants. The researchers opted to keep the discussion board anonymous to prevent issues of coercion due to participants' existing academic roles. The discussion board entries were included for triangulation purposes and to ensure trustworthiness of the data (Doyle, 2007).

Also, while no formal definition of academic mentoring in research was introduced to the participants, they all concluded that this involved their immediate research mentors or mentees in academia. This allowed us to identify a coding scheme from the first cycle of coding (holistic coding) (Boyatzis, 1998; Saldaña, 2009). Through this first cycle of coding, a codebook was initially developed and further refined through a combination of inductive and deductive thematic analysis (Saldaña, 2009), which led to a second cycle of coding consisting of values coding. Values coding entails coding for attitudes, values, and beliefs that form and influence a participant's identity and interpersonal experiences (Saldaña, 2009). The codes for 'values', 'attitudes', and 'beliefs' were defined by using Saldaña's (2009) explanations as a baseline and then placed in the context of science and engineering academic mentoring in research between faculty and graduate students. We selected values coding, as part of our secondary cycle of coding because through this lens, we can better understand the experiences and representations that individuals posit about themselves (e.g., institutional identity), about their interactions with others (e.g. social identity) and potential discourses (e.g., discourse identity) within science and engineering. Analyzing "participant's values, attitudes, and beliefs" (Saldaña, 2009, p. 131), we identified that in our data: (a) values represented the importance that graduate students and faculty attributed to each other in an academic research relationship; (b) attitudes included the way graduate students and faculty thought about each others' roles in an academic research relationship; and (c) beliefs consisted of the interpretive perceptions that graduate students and faculty have about the ethics and equity of academic mentoring in research in science and engineering. A summary of the coding scheme is provided as a supplementary material in the manuscript (Appendix A).

The codes developed at the time of the study was analyzed using a coding software, MAXQDA 12. We engaged in intercoder agreement discussions for one representative faculty and graduate student as well

as conducted an external check on the coding process throughout the two interviews (Creswell, 2014). The data was independently coded and discussed between three researchers. The discussions yielded with a 96% agreement of codes and the remainder was iteratively deliberated until a full consensus was achieved. From this consensus, a final codebook was developed and used.

4.9. Quantitative data collection and analysis (quan)

For quantitative data collection and analysis, establishment of a control condition was needed for statistical comparisons. However, from an intersectionality-informed approach, assuming a control condition would imply that quantitatively, elements of inequity can be investigated via an *individual* axes of identity (e.g., 'race', gender, class, sexuality) rather than exploring the fluidity and interacting influences of various forms of identities (Cooper, 2016; Rouhani, 2014). At the same time, we did not want to prescribe the title "token" to participants in science and engineering solely based on an erred assumption of their sex or color (Bowleg, 2008). We posit that as researchers, we must put care into how we prescribe participants based upon categorical variables to fit traditional forms of quantitative analysis (Hunting, 2014).

Subsequently, the research team opted to allow the participants themselves to express if they identified tokenism throughout the cases, which could highlight a communicated form of discourse identity (Goffman, 1981). If most or all participants reported: "No, I can't see tokenism here" for a particular case, this case was considered a control since their responses were not expected to vary across the two interviews. Also, participant sub-groups were considered through: (a) the intensity of EDA arousal as evidenced through an increase in peak counts; (b) the statistical significance of normalized mean phasic EDA values of the cases when compared across the interviews; (c) participants' self-identified institutional identity (e.g., faculty versus graduate students); and (d) their self-identified social identity (e.g., underrepresented womxn in science or engineering field). It is important to note that groups needed to be clustered to allow for more statistical robustness and to further protect aggregated participants from being identified (Allen & Wiles, 2016; Christians, 2005). Moreover, we were careful to consider multi-stage statistical models (Del Toro & Yoshikawa, 2016; Rouhani, 2014) to better explore the interdependent relationships of these identities (Rouhani, 2014).

To process and analyze the EDA raw data, each case per interview per participant was separated using the timestamping program to determine the onset of each interview questions per case. It is important to note that raw EDA data is collected at 4 Hz (every fourth of a second). The average time of each interview ranged from 60 min to 75 min, meaning that each participant yielded between 14,400 and 18,000 data points. Furthermore, when collected in raw form, EDA signals contain two forms of data: (a) *tonic EDA* or the baseline signals an individual has because they are alive and breathing; and (b) *phasic EDA*, which represents the more immediate and reactive responses due to a particular stimulus (Boucsein, 2012). Thus, for analysis, the phasic EDA needed to be extracted as it would represent participants' near-real-time reactive responses to the cases and interviews (Boucsein, 2012; Boucsein & Backs, 2000, 2009). For this, an open-source MATLAB program (Ledalab) was used to separate the signals as recommended by Benedek and Kaernbach (2010a, 2010b). Ledalab uses a custom-created algorithm that allows the raw EDA data to be normalized and deconvoluted in order to separate the phasic from the tonic EDA data (Benedek & Kaernbach, 2010a, 2010b).

Upon extraction of the phasic EDA data, each individual data profile had to be normalized or *range-corrected*, as it is commonly referred to in the physiology literature (Boucsein, 2012; Lykken & Venables, 1971; Lykken, Rose, Luther, & Maley, 1966). Range-correction allows researchers to reduce the variance caused by larger and more significant treatment effects (Lykken et al., 1966) and to account for intra-individual differences (Villanueva, Campbell, Raikes, Jones, & Putney, 2018). The mean of the range-corrected phasic EDA was then calculated and filtered to exclude values of under 0.05 microSiemens as recommended by Boucsein (2012). To avoid misleading distortions in the analysis (Villanueva et al., 2018), the authors opted to normalize participant responses to the case studies and across the interviews. This would also allow the research team to better isolate and compare psychophysiological responses among participants.

To understand the way in which the interviews and groups could relate to each other, a multivariate ANOVA model was input into a SAS 9.4 statistical software program to generate the factors (e.g., career trajectory, interview, and interactions of groups to the case) from each participant group. Also, Least Squares Mean estimates were calculated to assess if there was a significance between several levels of independent variables.

4.10. QUAL + quan data integration from an intersectionality-informed lens

At the same time, we recognize that intersectional identities of individuals could result in differing outcomes (Del Toro & Yoshikawa, 2016; Hunting, 2014; Rouhani, 2014). As such, our approach based on applied multi-modal methods (blending electrodermal activity recordings with interview protocols; Villanueva et al., 2014) on a limited number of participants to more meaningfully study the number and types of intersections explored (Del Toro & Yoshikawa, 2016; Hunting, 2014).

One of the unique elements of this work was the implementation of a custom-developed interview protocol (Villanueva et al., 2014) that incorporated psychophysiological arousal tools (i.e., electrodermal activity) to understand and measure participants' emotional processing (via electrodermal activity) of sensitive topics of mentoring in higher education. Also, as womxn in fields like science and engineering are labelled as tokens (Seron, Silbey, Cech, & Rubineau, 2018) or as underrepresented (NSF, 2017), we were interested in understanding if they were aware or agreed with these tokenistic labels in their disciplines and contexts.

The overarching motivation for integrating psychophysiological tools with interview protocols (Villanueva et al., 2014) in a multi-modal manner was to respond to a wider call from the educational psychology and social psychology community to re-image studies related to issues of race (DeCuir-Gunby & Schutz, 2014; Matthews & López, 2019) and gender. In our case, we were interested in exploring how academic mentoring can be race re-imaged from a perspective of intersectionality (e.g., social, institutional, discourse identity standpoint) (Hunting, 2014; Rouhani, 2014), tokenism (e.g., Niemann, 2016), and awareness (e.g., Winkielman & Schooler, 2011) through new methods discussed here. Through interview protocols and biometric technology, our study aimed to pilot a new approach for data collection and analysis (Rouhani, 2014) while making a conscious effort to minimize the assumptions behind isolating inequity dimensions (Bowleg, 2008; Rouhani, 2014).

Additionally, we cannot dissociate all the historical, social, or contextual (Crenshaw, 1989) and thus, we wanted to explore how different individuals emotionally or mentally processed conscious or unconscious information (Immordino-Yang & Christodoulou, 2014; Winkielman & Schooler, 2011; Winkielman et al., 2011) throughout our interviews around cases of academic mentoring in research. To our understanding, no one has attempted to use multi-modal approaches to accomplish this goal.

When integrated, the EDA profiles as well as the themes identified allowed the research team to identify the role that participants' moderating variables (e.g., race) and psychophysiological responses had for each interview and case study. Additionally, both the coding scheme and the electrodermal activity was used to identify themes and potential underlying psychophysiological responses that could indicate if a particular identity (e.g., social identity) was at play during the

interview. This triangulation of both QUAL and quan data informed the researchers on potential themes that might have been overlooked during analysis and permitted us to revisit any, if needed. This mixed-methods and multi-modal approach further allowed us to perform an internal "ethical check-list" of the coding process and of ourselves during our coding procedures (Palm & Hansson, 2006, p. 544). Since it is important to re-image studies related to issues of race (DeCuir-Gunby & Schutz, 2014; Matthews & López, 2019) and gender, the research team deemed it important to expand the methodologies used as well (DeCuir-Gunby & Schutz, 2014).

5. Results

5.1. QUAL findings

We wanted to understand if intersectionality played a role in these womxn's perceptions with and without the subliminal presentation of a definition of tokenism. Furthermore, through the themes identified, we determined that participants' responses varied according to their specific intersectional identity, which was identified as including their self-identified race/ethnicity, domestic and international status, and academic role. Therefore, we created three subgroups: (a) Group 1, domestic White graduate students (participants one through four); (b) Group 2, domestic or international, multiracial graduate students (participants five through eight); and (c) Group 3, domestic or international, White Faculty (participants nine through twelve). The participant demographic breakdown can be found in Table 1.

Recurrently, issues of power, communication, and awareness were found and findings related to the first interview have been discussed elsewhere (Gelles et al., 2019). The findings summarized below compare and contrast the differences found in these groups across the two interviews and expand upon the second interview, where a definition of tokenism was shared with the participants.

5.1.1. Power

All participants were aware of the imbalance of power that exists between a graduate student and faculty, as evidenced primarily through the achievement-equity case study. All groups agreed that in science and engineering fields, maintaining boundaries was important (as found in interview #1; Gelles et al., 2019) but that there was a certain level of flexibility needed in order to know: (a) when and when-not to 'push' mentees too hard; (b) when to be encouraging and caring; and (c) how to not exploit ideas for authorship. In the second interview, when the definition of tokenism was presented, participant responses varied. Group 1 (White graduate students) emphasized on the importance of valuing inputs and labor for work while Group 2 (multiracial graduate students) focused on the importance of equal treatment in terms of challenging them in research opportunities that may appear. Group 3 (White faculty) indicated that graduate student mentees should be self-aware about asking others for help and suggested to find peers who are experiencing similar situations to the case.

5.1.2. Communication

This theme was primarily emphasized in the gender-equity case study (Autonomy). In the first interview, all groups alluded to the importance of communicating to each other's professional interests, including non-academic ones. There was an emphasis placed by the Group 1 (White graduate students) and 2 (multiracial graduate students) on the need for open communication about the subliminal pressures present in research environments while Group 3 (White faculty) focused on the importance of graduate students communicating their professional needs to their faculty mentors. For the second interview, when the definition of tokenism was presented, responses changed. Group 1 indicated the importance of a having a faculty member reveal and communicate expectations to their graduate student mentees and gave emphasis to the importance of promoting professional interests without crossing personal boundaries or igniting oppressive forces by attempting to cross these boundaries. Group 2 emphasized on the importance of respecting different ideas in research and considered the merits and life experiences of each graduate student mentee. Group 3 emphasized on the importance of having mentees develop a self-awareness of how a faculty mentor's career path can reflect upon their own behaviors and perceptions and the importance of leaving a relationship that may not be considered a match. Group 3 mentioned the importance a mentor plays in communicating and making their graduate student mentees aware of the motivations behind their intents during career planning discussions.

5.1.3. Awareness

This theme became more apparent through the race-equity study (Fairness). In the first interview, all groups agreed that discrimination should not be present in hiring decisions. Group 1 (White graduate students) and 2 (multiracial graduate students) placed an emphasis on the need for faculty to provide honest and objective evaluation of students and base their decision solely on academic qualifications and no other factors. At the same time, they also acknowledged that other things (e.g., personality fit) could contribute to these decisions. Group 3 (White faculty) added that rejected students should have communicated with the faculty member first before raising issues of discrimination anywhere else. For the second interview, when the definition of tokenism was shared with the participants, responses varied. Group 1 participants emphasized on the need for transparency on hiring decisions whereas Group 2 graduate students talked about the importance of considering equitably the abilities and credentials of an individual and not base decisions on personal factors that could further social injustices. Group 3 faculty participants emphasized that mentees should report the incident but also consider potential retaliatory actions that may transpire as a result. They also talked about the importance of instructor fit in faculty-graduate student relationships.

Together, the qualitative findings between the interviews and across the case studies suggests the potential subliminal and reflective ability that the definition of tokenism itself had in these interview responses, particularly as found throughout the second interviews.

5.2. quan Findings

In identifying a control condition for the quantitative components of this research, an analysis of the instances where participants identified or not tokenism for a case study was tabulated. The research team found that among the case studies, all groups did not report issues of tokenism in one of the case studies (Achievement-equity or Beneficence; Table 4). This led us to consider the case study of

Table 4
Frequency of participant responses indicating if they perceived issues of tokenism in the case studies in interview 2.

	Group 1 White Graduate Students (n = 4)		Group 2 Multiracial Graduate Students (n = 4)		Group 3 White Faculty (n = 4)	
Found Issues of Tokenism?	Yes	No	Yes	No	Yes	No
Control (Beneficence)	0	4	0	4	0	4
Gender-Equity (Autonomy)	4	0	2	2	1	3
Race-Equity (Fairness)	2	2	2	2	0	4

Table 5
Mean peak counts of participant group EDA responses for the first and second interviews.

	Control (Beneficence)		Gender-Equity (Autonomy)		Race-Equity (Fairness)	
	Interview 1	*Interview 2*[+]	*Interview 1*	*Interview 2*[+]	*Interview 1*	*Interview 2*[+]
Group 1	37	10	19	13	20	14
Group 2	23	23	12	26	15	14
Group 3	12	6	7	8	8	3

[+] Interview 2 included a definition of tokenism that was shared with participants contrary to Interview 1.

Beneficence as a control condition as most participants could not definitely state tokenism was present in this case study, potentially suggesting that this case could be a norm or expected scenario in their fields of science or engineering.

To begin to answer the second research question and to further corroborate that the selection of the achievement-equity case (Beneficence) as a control was appropriate, an analysis of the mean peak counts for the phasic EDA data was compared for the participant groups. Mean peak counts for phasic EDA data represents the intensity of arousal response by participant groups to a particular event (Boucsein, 2012). As seen in Table 5, the achievement-equity case (or Beneficence) was the only case where participant groups showed either a decrease or no change in EDA arousal intensity from the first to the second interview. Upon closer examination of the Table 5 findings, the research team noticed that Group 1 (White graduate students) showed an overall reduction in intensity of EDA arousal throughout all cases when the first and second interviews were compared. Group 2 (multiracial graduate students) had an increase in intensity of EDA arousal in the gender-equity case but not in the other two cases in the second interview. Group 1 (White graduate students) and Group 3 (White faculty) showed a reduction in intensity of EDA arousal throughout the interviews for the achievement-equity case (Beneficence) and for the race-equity case (Fairness) but did not appear to change drastically for the gender-equity case (Autonomy). To further highlight the differences in these arousal responses, representative normalized phasic EDA profiles for the three cases for the second interview are included in Fig. 3.

A multivariate ANOVA model was conducted. This statistical model used a recommended two-stage analytical strategy for intersectionality studies: an additive "analysis of main effects of inequities in social identities […] …, followed by statistical interactions between effects" (Rouhani, 2014, p. 8) of the mean phasic EDA data by groups, cases, and interviews. The results showed a possible relationship between the variables ($r = 0.37$, $p \leq 0.001$; Ellis, 2010). The resultant model is shown in Eq. (1):

$$\begin{aligned}\text{Mean Phasic EDA} = {} & \text{Institutional Identity (}\textit{faculty vs. graduate student}\text{)} \\ + {} & \text{Discourse Identity (}\textit{interviews with and without the definition of tokenism}\text{)} + \text{Social Identity (}\textit{case study stimuli}\text{)} \\ & + \text{Institutional Identity} \\ & * \text{Discourse Identity (}\textit{interaction}\text{)} \end{aligned} \quad (1)$$

The N-way ANOVA results for this model are summarized in Table 6 and Table 7. Even with small sample sizes, we found that one form of identity can be moderately explained by the other in our model although institutional and discourse identity appeared to have the higher presences. Exploring each variable in more detail, we find that all forms of identities showed a significant difference in mean phasic EDA response, but the interaction between institutional and discourse identity had a cooperating influence.

Upon normalization, range-corrected mean phasic EDA values were calculated to identify and compare collective psychophysiological responses among participant groups and across the interviews. As shown in Table 8, no significant differences were found across the interviews for each of the groups. When analyzed individually, the first and second interview had some significant findings. For the first interview, a probable difference in normalized EDA arousal was found when comparing Group 1 (White graduate students) and Group 2 (multiracial graduate students) in the control case study ($p < .05$) whereas Group 2 had a higher arousal ($M = 0.76$) compared to Group 1 ($M = 0.57$); no changes were found in the second interview. For the gender-equity case, in the second interview, Group 2 participants (multiracial graduate students) had higher arousal ($p < .01$) compared to Group 3 (White faculty) participants ($M = 0.87$ versus $M = 0.79$, respectively). Also, in this same case and interview, Group 1 participants (White graduate students) had higher arousal ($p < .05$) compared to Group 3 participants ($M = 0.93$ versus $M = 0.79$, respectively). For the race-equity case, in the second interview, Group 1 participants had significantly higher arousal ($p < .01$) compared to the Group 3 participants ($M = 0.87$ versus $M = 0.66$, respectively).

5.3. QUAL + quan findings

To explore the third research question, the integrated findings represented several interesting observations. Comparing the two interviews side-by-side, no significant differences in the range-corrected mean phasic EDA values were found. However, it was evident via participants' verbal responses to the questions, that disparate identification of tokenism was present among the groups. There was a split in views of the role that tokenism could play in the levels of awareness needed by mentors and mentees to overcome challenges present on issues of gender and race in academic research. These differences were primarily found between the faculty and graduate student group responses.

A representative triangulation table that includes both qualitative and quantitative findings of one of the second interview can be found in Table 9 for the race-equity case study. In this representative example, we find that between the faculty participant (Kendra) and the graduate student (Kate), psychophysiological discrepancies are visibly evident despite the qualitative themes being essentially the same (issues of power and privilege and disjointed views of tokenism). Together, this suggests that discourse identity, particularly in the way that participants expressed their understanding of the case study through linguistic and non-linguistic means resulted in differing psychophysiological responses. While institutional identity could have played a role in this example (e.g., graduate students and faculty), their qualitative responses suggest contrary.

Furthermore, when the research team shared a definition of tokenism to participants with the same institutional identity (all graduate students) during interview 2, there was a reduction in EDA arousal intensity found among the control cases although it remained constant for Group 2 (multiracial graduate students) participants. It was interesting to note that this observation across the interviews also occurred in the race-equity case where varying strategies for affected graduate student mentees was discussed, suggesting that social identity may be at play. To further highlight this latter point, we present some of the qualitative responses from two participants: Kate (Participant 1, Group 1, White graduate student) and Carrie (Participant 8, Group 3, Latinx graduate student) for the second interview and on this case.

Kate suggested that the Latinx student present in this case needed to

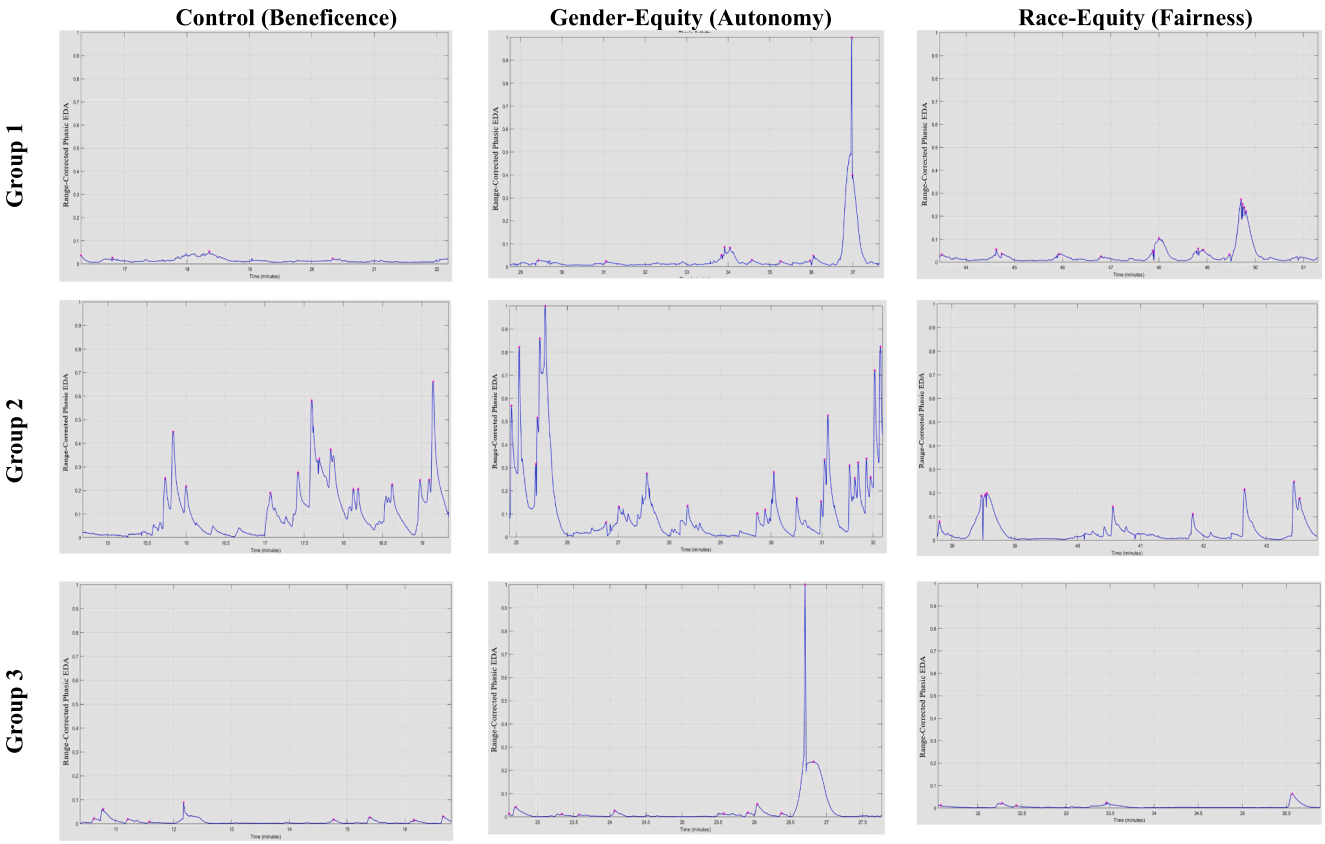


Fig. 3. Representative range-corrected phasic EDA profiles of individual participants within the three groups: Group 1 (White graduate students), Group 2 (multiracial graduate students), and Group 3 (White faculty) for the second interview; y-axis represents unitless normalized phasic EDA values between 0 and 1; x-axis represents the time (in minutes) in the second interview where the cases were presented to the participants; for all profiles, background brightness was reduced to allow for heightened visibility of the graphs.

Table 6
N-way ANOVA testing of significance for the model using mean phasic EDA.

Source	Degrees of Freedom	Sum of Square	Mean Square	F Value	$P_r > F$
Model	11	4.509	0.4099	25.64	<.001

Table 7
N-way ANOVA testing of significance for each model variable using mean phasic EDA.

Source	Degrees of Freedom	Type I Sum of Square	Mean Square	F Value	$P_r > F$
Institutional Identity	3	3.1839	1.0613	66.38	<.001
Discourse Identity	1	0.2519	0.2519	15.76	<.001
Social Identity	5	0.2662	0.0532	3.33	.0055
Institutional * Discourse Identity Interaction	2	0.8072	0.4036	25.24	<.001

"approach another faculty member, maybe even another Hispanic faculty member if there is one" and then proceed with other faculty or other administrators in the department (Kate, Graduate Student, Interview 2, File 2, Fairness Case). However, when this participant was asked what they would do if placed in that same situation, Kate indicated that she would have approached the fictitious faculty member, Dr. Select, directly by demanding "a genuine answer for why this student was accepted over myself as a minority student." (Kate, Graduate Student, Interview 2, File 2, Fairness Case). It was interesting to compare Kate's response with Carrie's (a Black/Latina graduate student) answer. Carrie brought her firsthand experience to the table, arguing that:

> Probably this happens continuously when people from minorities are included in a group, but they are discriminated within the group. […] they [people in academia] include them [minoritized students] because of the money they get. This is happening world-wide, now even more in America because in America they are more concerned about discrimination happening, and that may lead to tokenism.
>
> Carrie, Graduate Student, Interview 2, File 2, Fairness Case, Line 472

According to Carrie, this case study presented both tokenism and an ethical issue because students from minority backgrounds are accepted into a program just to comply with a quota but they are not granted the same resources (e.g., the possibility of being mentored by the faculty they choose) to be successful. While Kate's positionality partially intersected with this case – the fictitious character in the case and Kate both come from minoritized groups – Kate is a White woman in science operating in privilege whereas the Latinx student in the case is not. As seen in this example, different levels of privileges and tokenistic statuses are connected to the intersectional identities of the participants and may influence their awareness of their privilege when reflecting upon this case.

One interesting finding was among the Group 3 participants where EDA arousal intensity responses were low for the control and race-equity cases and minimal increases were found for the gender-equity studies across the interviews. This suggests that psychophysiological responses and awareness to the cases may have been heightened by their identified social identities. Maintaining institutional identity the same (all graduate students), we found that Group 2 participants

Table 8
Range-corrected phasic mean EDA (standard deviation) for the participant groups for each case and interview.

	Control (Beneficence)		Gender-Equity (Autonomy)		Race-Equity (Fairness)	
	Interview 1	*Interview 2*[+]	*Interview 1*	*Interview 2*[+]	*Interview 1*	*Interview 2*[+]
Group 1	.57(.30)	.73(.34)	.82(.23)	.93(.20)	.71(.30)	.87(.24)
Group 2	.76(.26)	.75(.37)	.76(.26)	.87(.24)[#]	.79(.24)	.79(.34)
Group 3	.71(.29)*	.72(.34)	.74(.31)	.79(.39)**	.65(.30)	.66(.40)**

*p < .05; **p < .01; ***p < .001 compared to Group 1 participants.
[#]p < .05; [##]p < .01; [###]p < .001 compared to Group 3 participants.
[+] Interview 2 included a definition of tokenism that was shared with participants contrary to Interview 1.

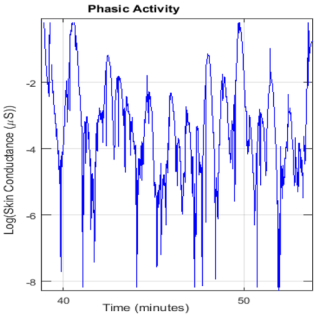
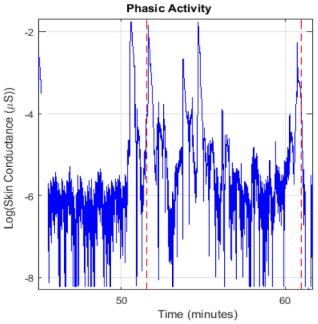
(representing an array of social identities) showed higher arousal intensities for the gender-equity cases. Possibly, this is due to disjointed views of the same case or a heightened self-awareness of a dimension of their social identities. If we kept social identity the same (e.g., White womxn) and changed institutional identity, for example, we found that in interview 2, where more forms of discourse identity was introduced, faculty showed higher EDA arousal responses. Upon closer examination of the qualitative responses, we found that for the gender-equity case, issues of power and oppression around topics of motherhood in academia became evident. For race-equity, issues of inequitable access and treatment based upon a concerted effort to meet the requirements of academia was found:

> I would expect my mentor to be a lot like Dr. Copie and to discourage, I mean he actually even said to me as one of my friends got pregnant during her Ph.D. to not hang around her as much because (laughs) we might catch that pregnancy bug basically. And just made totally inappropriate comments and her advisor made comments that were just wildly inappropriate, and so yeah, uh, I guess I expect that this is the treatment that women in Ph.D. programs get when it comes to starting a family. It's just not a conversation that's allowed and it's a huge turn off for me in terms of academia because it never feels like there's a right time. Don't start a family during a doctorate, well you sure as hell can't start it when you're a junior faculty before tenure, and so it's like next thing you know you're going to be like 35/40 and you know maybe you've put your life on hold, so I don't know. I would expect my advisor to be the exact same and, um, with regards to the Tokenism issues that I see in the paper…(deep breath) I don't agree with it but I would just expect him to behave the same way (laughs uncomfortably).
>
> Kate, Graduate Student, Interview 2, File 2, Gender-Equity Case, Line 317

> …But I think I do have some bias a little bit towards… some of the students […] not native English speakers […] I don't have any problems that they are not native English speakers. It's more that it requires a lot of work on my part to bring their writing up to where it needs to be. That's probably my biggest complaint about that. And so I know I have…I know there's been instances where somebody has come talk to me and I can just tell that their writing and the way that they present themselves is really not where it needs to be.
>
> Hailee, Faculty, Interview 2, File 2, Race-Equity Case, Line 174

However, it is important to mention that not all participants viewed the same issues in a negative light. Some participants were very aware of their roles and responsibilities and expressed a desire to maintain race- and gender-equity in these types of mentoring as evidenced in

Table 9
Representative triangulation scheme combining the EDA profiles/case and participants' responses to the interview cases; the thicker lines on the EDA graphs represents higher arousal intensities.

Participant	Theme Identified	Representative Quote per Case	EDA profile/case time window
Graduate Student #1 (Kate)	• Issues of power and privilege • Disjointed view of tokenism	**Race-Equity Case:** "I can see that issues of tokenism are totally relevant to this case study" (Audio file, min. 10:48_10:54) "**I would encourage the [Latinx] student to perhaps approach another faculty member, maybe even another Hispanic faculty member**, if there is one, and talk to them, or the department head and figure out, trying to get information about what motivated… (Audio file, min. 12:18_13:10). "If they brushed me off and said "I don't owe you an explanation" then, I would be pretty upset and try to contact people who are higher up into the department or the university to kind of investigate if there was actually discrimination going on. But I guess I would hope if I was placed in this situation **I could approach Dr. Select and try to get a genuine answer for why this student was accepted over myself as a minority student**" (Audio file, min. 14:24_15:17).	
Faculty #4 (Kendra)	• Issues of power and privilege • Disjointed view of tokenism	**Race-Equity Case:** "The white male students have always dominated in this field and it is **problematic to think that more qualified students who happens to be not white students would not be chosen**, there are some serious ethical issues going on for sure." (Audio file, min. 49:54_50:10) "We have a basically entire white student body, which is kind of depressing, not diverse. And I could see that in the interest of trying to include different minorities within our graduate student's body there could be the possibility that you would bring in a student because they do represent **an underrepresented minority but perhaps doesn't have… background… not background, qualifications**." (Audio file, 57:59_59:08).	

their qualitative responses as well as EDA levels (e.g., Group 1 and 3, Interview 2, Control versus Gender-Equity Case; Table 5 and Table 9).

> Yeah, it's I think it's always good to realize that the path that you took is not the path for everybody and it may be the path for a few people and so particularly you may identify with a particular student of yours if they share the same gender that it's okay for them to have their own career trajectory and as long as they are on a pathway towards success and that success may be defined in a very different way than you define it. That that's…that's okay.
>
> Kendra, Faculty, Interview 2, File 2, Autonomy Case, Line 357

6. Discussion

In this study, we aimed to explore and magnify the voices and psychophysiological responses of womxn graduate students and faculty in science and engineering, who may encounter experiences of tokenism in academic mentoring in research. We considered both their conscious responses (verbal answers to the interview) and their unconscious reactions (EDA psychophysiological signals) in the interviews, although a primary emphasis was still provided to their voices through QUAL approaches. In other words, when adding EDA techniques to an interviewing method, the researchers were able to observe both the unconscious and immediate reactive response through skin conductance and the *conscious* mediated oral responses through their answers to the interview questions. Recording the skin conductance provided a picture that helped us to corroborate and reinforce the verbal messages and awareness conveyed by the participants in the interviews.

We explored how moderating variables (e.g., race, gender, academic role) interacted and served to reflect the systems of power and social stratifications that led to inequities among individuals across disciplines (i.e., science or engineering) and environment (i.e., academia). Each individual, has a *position* in society and such position determines the distance and relations the individual establishes with others (Maher & Tetreault, 1993; Villaverde, 2008). Given the intertwined global/local dimension in which we live in, we strived to understand how intersectional identities (e.g., institutional, discourse, social identity) were complexly interwoven and how they guided the hybrid and diverse perspectives and experiences of our participants (Camicia & Di Stefano, 2015). In our study, the case studies and interviews provided a conducted that promote reflection of their identities, similar to the water pipe analogy (Fig. 1).

It was encouraging to find that all participants commonly recognized the presence of and differences of power and privilege between faculty mentors and graduate students based on their intersectional identities. There was also a common recognition that maintaining a respectful boundary between personal and professional lives was important in maintaining a healthy academic mentoring in research relationship. The differences lied around the conscious and unconscious forms of psychophysiological processing as well as their levels of awareness of their intersectional identities.

The disjointed views about their tokenism revealed the role that experiences and intersectional identities played in participants' awareness to varying experiences and viewpoints. For example, some of the womxn faculty in this study could not recognize tokenism because in their laboratories, most of the hired graduate students were of the same gender (data not shown). Yet, it was still evident via their recognition of the gender-equity case (Autonomy), that inequalities regarding gender was not uncommon in their fields and that for some of them, the simple presence of womxn in labs and fields of study is not enough to guarantee that their voices are heard or that their expertise is valued, even with mentoring. This point emerged clearly when graduate student participants such as Kate examined the gender-equity case, where the fictitious graduate student, Sandra, was being discouraged about starting a family. Similarly, other participants expressed their frustration on the tacit expectation placed on womxn's role in academic research.

With the inclusion of the psychophysiological findings via EDA, we were able to confirm that participants reacted differently to each case study but that within different forms of identities, group responses could be found. One interesting observation made was found between the control case (Beneficence) and the race-equity case (Fairness). For these cases, all groups responded in the same way: Group 1 (White graduate students) and Group 3 (White faculty) had a reduction in EDA arousal intensity to the cases whereas Group 2 (multiracial graduate students) had a sustained intensity between the interviews (refer to Table 7). This EDA arousal intensity did not mirror to the gender-equity case (Autonomy) among the participant groups. It is possible that the presentation of a definition of tokenism may have elicited unconscious or meta-conscious processes that may have influenced their awareness (Son Hing et al., 2005) to these types of race-inequities in their fields of science or engineering. On the other hand, it is possible that the subliminal presentation of the tokenism definition may have ignited affective reactions that were reflected in these psychophysiological measures (Winkielman et al., 2011) and in their responses to these topics (Villanueva et al., 2014). Further work is needed to dissociate these mechanisms better. Through these diverse perspectives and psychophysiological responses, our studies further corroborates and documents the race and gender inequalities that continues to be experienced among faculty (Medina & Luna, 2000; Niemann, 1999, 2012, 2016) and student populations (Mondisa, 2015; Pollak & Niemann, 1998) in higher education.

Nonetheless, in our study, incorporating EDA allowed the research team to more deeply and holistically understand the perspectives and reactions of these womxn to issues of race- and gender-equity in academic mentoring in research for fields like science and engineering. Through EDA, we were able to better understand the nearer-real-time electrodermal activity responses of participants during interview protocols (Boucsein & Backs, 2000, 2009; Boucsein, 2012), and served to complement the qualitative research approaches used in this study. Together, it is our hope that through this work, we have presented a unique and way to race re-image studies (DeCuir-Gunby & Schutz, 2014; Matthews & López, 2019) around academic mentoring.

7. Limitations and directions for future work

Given the innovative approach of this protocol, the study comes with its sets of limitations. For example, we were not able to randomize the interviews as we would have wanted to in order to get more statistically relevant results. This may have led to some conditioning in participants' reductions in EDA to some of the cases based on repeativeness of a stimuli. Randomizing the questions and interviews would have required additional coding and EDA data processing to ensure that the interview questions were both different in nature and of a different scope, which would have changed the original intent of this work. Also, EDA as well as interview findings represents a glimpse of time where participants responded to a context and may not fully represent their day-to-day experiences and viewpoints. However, the new level of insight gained by integrating both qualitative interviews and psychophysiological arousal measures, can allow for more detailed understanding of potential associations between the two and to complex topics.

While the sample size for the qualitative portion of the study was appropriate (e.g., 4–12 participants; Morse, 1994), quantitatively it may not represent a robust enough number of participants. Given that the population of womxn in engineering is very low (NSF, 2017; UNESCO, 2016), we understand the need to still prioritize their voices and interpretations of such over quantitative approaches. Nonetheless, we have aimed to expand the notion of intersectionality-informed research to consider the "fiscal, emotional, psychological, and other categories" (Kwan, 2000, p. 687) and expand the empirical sources used

to evidence these intersecting identities. Furthermore, for our statistical results, while some interpretations are drawn, it is hard to definitely make an inferences without gauging the strength of its effects (Wasserstein, 2016).

It is important to mention that during the interviews, some participants (particularly those from multiracial groups) shared with us experiencing distressing issues in their existing mentoring relationships and they expected their EDA levels to be high. This was confirmed when looking at the raw data. As a result, we had to consider that EDA analysis required intersectionality considerations. For instance, older literature suggests that baseline skin conductance levels varies among different races (Korol & Kane, 1978). Other sources suggests that pre-existing anxiety levels (Boucsein, 2012) and psychological context plays more predominant roles in participants' arousals responses (Boucsein & Backs, 2000, 2009). While no current literature has explored the advances with existing electrodermal activity technologies in mitigating these limitations, the research team deemed it necessary to normalize the EDA data among the individuals in our study. While this may have reduced some interpretations in our data, normalizing allowed us to minimize any misrepresentations due to "intersections of race and sex, or to any other category" (Cooper, 2016, p. 390).

We also recognize that womxn's experiences as analyzed in our EDA data cannot be analyzed in one way (e.g., focused solely on race and sex; e.g., Crenshaw, 2012) and as such, qualitative findings in our data helped us understand the larger contexts and authoritarian systems of oppression (Cooper, 2016; Crenshaw, 2012) that influenced the lens and responses of these participants to the case studies. At the same time, our findings points to the need to explore more holistically the experiences (through expressions and psychophysiological responses) of minoritized groups in fields like science and engineering in academia, which parallels recent calls from researchers (Levecque, Anseel, De Beuckelaer, Van der Heyden, & Gisle, 2017; Price & Kerschbaum, 2017). Future work will explore additional intersecting identities in these contexts using our methods.

Finally, with further automation of our methods, the cost of signal processing, filtration, modeling, normalization, and interpretation of EDA may be significantly reduced to allow us to recruit more participants on a larger scale and better represent these and other intersectional populations. This exploratory study represents an exciting and potentially new approach race re-image (DeCuir-Gunby & Schutz, 2014; Matthews & López, 2019) academic mentoring.

8. Conclusions

This work is significant to educational and social psychology as it can shed light on how participants internalize and externalize topics such as academic mentoring within interview protocols. At the same time, the methods used in this study can help inform complementary quantitative methods to traditionally qualitative techniques for intersectionality-informed research.

In this study, we aimed to examine the intersectional perspectives and psychophysiological responses of academic mentoring in research for womxn faculty and graduate students who are traditionally considered tokens in their fields of science and engineering. Our qualitative findings suggested that participants in the first interview: (a) recognized the differences of power and privilege in research relationships based on their intersectional identities; (b) expressed common views of the need to communicate professional interests, even non-academic ones to graduate students; and (c) recognized the existence of discrimination in research admission processes and the need for more awareness on this topic. Interestingly, in the second interview, when a definition of tokenism was presented to the participants, each of their responses differed based on their specific intersectional identity. Our quantitative findings suggested that compared to a participant-derived control (the achievement-equity case), an increase in electrodermal activity intensity was found for the gender-equity case among multiracial graduate student participants while no changes or decreases were found for primarily White/Caucasian participants. Also, among White graduate students and faculty, a decrease in electrodermal activity was found for the race-equity case study compared to the control case. Collectively, participants' verbal and electrodermal responses for the two types of interviews and across the same cases suggested a disparate identification of tokenism among the participants and between womxn faculty and graduate students. Through the methods and findings of this exploratory study, a unique way to race re-image studies of academic mentoring was introduced.

9. Data statement

The aggregated and de-identified forms of the qualitative research data, upon written request to the corresponding author, can be made available for access upon publication of the manuscript. However, per IRB guidelines, all psychophysiological data must be destroyed upon the completion of relevant manuscripts to protect the confidentiality and biological/medical information from the participants.

Declaration of Competing Interest

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cedpsych.2019.101786.

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